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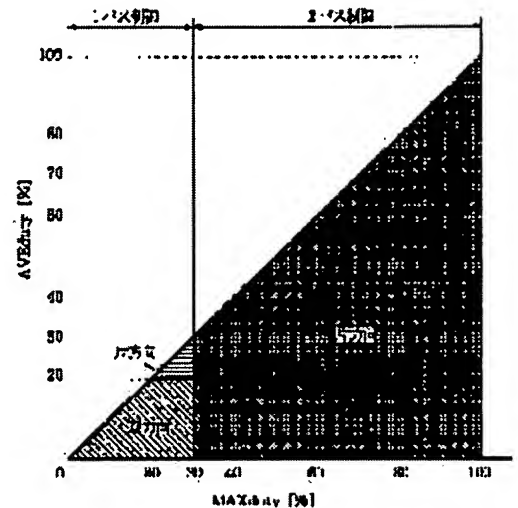
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(54) RECORDING METHOD AND RECORDING DEVICE THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a recording method, with the reduction of the power source capacity of a device is possible under the state that the recording quality is kept at a high grade, and its device.

SOLUTION: Data stored in a line buffer is divided in a plurality of segments. An average effective pixel percentage is calculated from two segments back and forth adjacent to each other. Regarding a recording band, a maximum average effective pixel percentage (MAXduty) is calculated so as to be compared with a predetermined threshold or more. On the basis of the result of comparison, whether the recording regarding the band is performed by a plurality of time of a carriage scanning or not is controlled. In addition, when the recording regarding the band is performed by one path controlling, the average effective pixel percentage (AVEduty) regarding the one band as a whole is calculated so as to decide whether the execution of forward and backward recording is necessary or that of only forward recording is enough on the basis of the value of the AVEduty.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the record approach of realizing low power-ization of the printer equipped with the recording head which has two or more record components especially, and its equipment, about the record approach and its equipment.

[0002]

[Description of the Prior Art] What used the hot printing method, the ink jet method, etc. as a recording method exists in the conventional serial printer. These equipments have two or more record element arrays, respectively, and record on a record form by scanning the recording head which has arranged those record element arrays in parallel with the conveyance direction of a record form at right angles to the conveyance direction.

[0003] By the way, in order to attain improvement in the speed of a recording rate these days, the inclination (expansion of the recording width of a recording head) which is made to increase the number of the record components which carry out internal organs to a recording head, and enlarges the recording width by 1 time of the recording head is remarkable. The need of on the other hand also increasing the capacity of the power source which makes a recording head driving with expansion of the recording width of such a recording head, enlargement of a recording head appearance, the cost rise of equipment, etc. are produced.

[0004] Now, although small, efficient, and a high-power switching adapter are spreading by advance of a switching power supply technique recently, such an adapter is expensive as compared with the AC adapter of the conventional transformer method.

[0005] The demand of the above increases of a power supply originates in increase of the power source altogether needed for the record produced with expansion of the recording width of a recording head. That is, when a record element number increases, it is for the record element number which must be driven in unit time amount to increase. For example, power source needed when recording the image of the concentration of an average of Z (%) by the ink jet recording head of n nozzle by regurgitation frequency f [Hz] and the driving pulse width of face T (sec) (P_n) $P_n = (I - V - n)$, $(T - f)$, and Z (1)

It becomes. Here, the current value of the rectangular pulse current to which I flows for each record component, and V are the current potential value.

[0006]

[Problem(s) to be Solved by the Invention] It turns out that it becomes so large that average concentration increases further, so that the number of nozzles of a power source (P_n) of a recording head (n) increases, and, so that I may be understood from a formula (1), and the regurgitation frequency f increases. Therefore, Z is the value of a proper at a record image, and in order that the fall of f may cause the fall of a recording rate, it is not desirable [in order to reduce the power supply demanded by one side, attaining increasing the record element number of the recording head for high-speed record (formation of many nozzles), it is required to reduce the value of I , V , f , Z , and T , but] to reduce f .

[0007] Furthermore, it is controlling maintaining the discharge quantity of ink uniformly etc. by there being some which have an incubation heater, in order to raise record quality to a recording head, for example, keeping the temperature of a recording head constant. When equipment sets under a low-temperature environment especially, the heater for incubation may be driven [be / it / under / record actuation activation / concurrency] and the heater is driven, in addition to heating of the component for original ink regurgitation, it is superimposed on heating to a heater, and big power is needed.

[0008] Therefore, attaining high-speed record, it is one side and it is not easy to reduce a power supply.

[0009] It aims at offering the record approach which can reduce the power supply of equipment, and its equipment, this invention having been made in view of the above-mentioned conventional example, and maintaining record quality to high definition.

[0010],

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the recording device of this invention consists of the following configurations.

[0011] Namely, have two or more record elements and the both-way scan of the recordable recording head is carried out by energizing to said two or more record elements. An input means to be the recording apparatus which records on a record medium, and to input record data from an external device, A storage means to store the record data corresponding to the record length recorded by one scan of said recording head as one unit, counting which carries out counting of the number of pixels corresponding to the data which were divided by division means to divide the record data for said one unit into two or more partitions, and said division means, and which are made to generate record actuation for every partition -- with a means said counting -- counting by the means -- by how many times scan of a recording head the record data of said one unit are recorded with a decision means to determine, according to a result It has the recording device characterized by having the 1st control means controlled to record by scanning said recording head based on the decision result by said decision means.

[0012] Moreover, according to other invention, have two or more record elements and the both-way scan of the recordable recording head is carried out by energizing to said two or more record elements. The input process which is the record approach which records on a record medium, and inputs record data from the exterior, The storing process stored in a storage by making into one unit the record data corresponding to the record length recorded by one scan of said recording head, counting which carries out counting of the number of pixels corresponding to the data which were divided in the division process which divides the record data for said one unit into two or more partitions, and said division process, and which are made to generate record actuation for every partition -- with a process said counting -- counting in a process -- by how many times scan of a recording head the record data of said one unit are recorded with the decision process to determine according to a result It has the record approach characterized by having the control process controlled to record by scanning said recording head based on the decision result in said decision process.

[0013]

[Embodiment of the Invention] This invention is equipped with two or more record elements by the above configuration, and the both-way scan of the recordable recording head is carried out by energizing to said two or more record elements. In case it records on a record medium, input record data from the exterior and it stores in a storage by making into one unit the record data corresponding to the record length recorded by one scan of a recording head. The record data for the one unit are divided into two or more partitions. For every divided partition of the the number of pixels corresponding to the data made to generate record actuation -- counting -- carrying out -- the counting -- according to a result, it determines by how many times scan of a recording head the record data of one unit are recorded, and it operates so that it may control to record by scanning a recording head based on the decision result.

[0014] The above control is still more specifically related with two or more of the divided partitions of each here. Average the number of pixels by which counting was carried out every two adjoining partitions, and the maximum number of pixels is computed from the equalized number of pixels. The maximum and 1st threshold are compared and you may make it choose whether the record data of one unit are recorded by one scan of a recording head, or two scans according to the comparison result.

[0015] In the selection, when the maximum is the 1st more than threshold, on the other hand, record by two scans of a recording head is controlled so that record by one scan of a recording head is made, when the maximum is the 1st less than threshold.

[0016] In addition, the number of pixels which is obtained about two or more divided partitions of each and by which counting was carried out is averaged, the average and 2nd threshold are compared, and you may make it control whether it is made to record in each outward trip and return trip of a scan of a recording head, or it is made to record only on an outward trip according to the comparison result. Here, when the acquired average is the 2nd more than threshold, it controls to make it record in each outward trip and return trip of a scan of a recording head, and on the other hand, when the acquired average is the 2nd less than threshold, it controls to make it record only on the outward trip of a scan of a recording head.

[0017] Moreover, the aforementioned storage is constituted as it has at least two data buffers which store the record data for one unit.

[0018] Furthermore, the ink jet recording head which records by breathing out ink is sufficient as the above-mentioned recording head, or it is a recording head which carries out the regurgitation of the ink using heat energy, and its ** equipped with the heat energy conversion object for generating the heat energy given to ink is also good.

[0019] With reference to an accompanying drawing, the gestalt of suitable operation of this invention is explained to a detail below.

[0020] <Approximate account of body of equipment> drawing 1 is the appearance perspective view showing the outline of the configuration of the ink jet printer IJRA which is the typical operation gestalt of this invention. In

drawing 1 , the carriage HC engaged to the spiral slot 5004 of a leading screw 5005 which is interlocked with the forward inverse rotation of a drive motor 5013, and is rotated through the driving force transfer gears 5009-5011 has a pin (un-illustrating), is supported by the guide rail 5003, and carries out both-way migration of an arrow head a and the direction of b. The recording head IJH and the one apparatus ink jet cartridge IJC which built in the ink tank IT are carried in Carriage HC. 5002 is a paper bail plate and presses the record form P to a platen 5000 covering the migration direction of Carriage HC. 5007 and 5008 are photo couplers and are a home-position detector for checking existence [in this region of the lever 5006 of carriage], and performing a hand-of-cut switch of a motor 5013 etc. 5016 is the member which supports the cap member 5022 which caps the front face of a recording head IJH, and 5015 is the aspirator which attracts the inside of this cap, and performs suction recovery of a recording head IJH through the opening 5023 in a cap. 5017 is a cleaning blade, 5019 is a member which makes this blade movable at a cross direction, and these are supported by the body support plate 5018. It cannot be overemphasized that not this gestalt but a well-known cleaning blade can apply a blade to this example. Moreover, 5021 is a lever for starting suction of suction recovery, it moves with migration of the cam 5020 which engages with carriage, and migration control is carried out by the transfer devices in which the driving force from a drive motor is well-known, such as a clutch switch.

[0021] When carriage comes to the field by the side of a home position, it is constituted so that a request can be processed according to an operation of a leading screw 5005 in those correspondence locations, but if it is made to operate to well-known timing about a request, each can apply these capping, cleaning, and suction recovery to this example.

[0022] Moreover, by control of the control circuit mentioned later, in the time of a carriage HC round trip scan, this printer can also perform record actuation in both that outward trip and return trip, or can also perform record actuation only at the time of that outward trip. Moreover, this printer can also perform record actuation by the so-called multi-pass control which controls record actuation by the carriage HC scan of multiple times to make record of the data stored in one line buffer mentioned later complete.

[0023] The control configuration for performing <explanation of a control configuration>, next record control of equipment mentioned above is explained. Drawing 2 is the block diagram showing the configuration of the control circuit of an ink jet printer IJRA. In drawing 2 which shows a control circuit, ROM which stores the control program with which MPU performs the interface into which 1700 inputs a record signal, and 1701, and MPU1701 performs 1702, and 1703 are DRAMs which save various data (record data supplied to the above-mentioned record signal or a recording head IJH). 1704 is a gate array (G. A.) which performs supply control of the record data to a recording head IJH, and also performs data transfer control between an interface 1700, and MPU1701 and DRAM1703. A carrier motor for 1710 to convey a recording head IJH and 1709 are the conveyance motors for recording paper conveyance. The head driver to which 1705 drives a recording head IJH, and 1706 and 1707 are Motor Driver for driving the conveyance motor 1709 and the carrier motor 1710, respectively.

[0024] If actuation of the above-mentioned control configuration is explained, and a record signal goes into an interface 1700, a record signal will be changed into the record data for a print between a gate array 1704 and MPU1701. And while Motor Driver 1706 and 1707 drives, a recording head IJH drives according to the record data sent to the head driver 1705, and record is performed.

[0025] Drawing 3 is drawing showing the nozzle configuration of the recording head IJH used with this operation gestalt. As shown in drawing 3 , the recording head IJH has 128 nozzles by the space consistency of 360dpi (dots per inch: dot per inch) in parallel with the conveyance direction of a record form.

[0026] Drawing 4 is drawing showing the configuration of the line buffer which a recording head IJH uses for record. A field required for such a line buffer is assigned in DRAM1703. As shown in drawing 4 , the double buffer which uses two line buffers (line buffers 1 and 2) is consisting of this operation gestalt. These two line buffers can store 128 dots, i.e., 1 dot (1 pixel) = 1 bit, then $2880 \times 128 / 8 = 46080$ bytes of record data in the scanning direction (main scanning direction) of a recording head IJH in the conveyance direction (the direction of vertical scanning) of 2880 dots and a record form, respectively. Furthermore, the data stored in these two line buffers are divided for every dot about a main scanning direction per 8 dots (1 byte) about the direction of vertical scanning for every line buffer, and the address is given to the each divided block sequentially from the upper left of each line buffer shown in drawing 4 . Although the value given to the blocks of each shown in drawing 4 carried out the hexadecimal notation of the address number, it shows the lower address.

[0027] Drawing 5 is drawing showing the correspondence relation between the data stored in the double buffer shown in drawing 4 , and the record form with which the data is recorded. Since the number of the data stored about the main scanning direction of a line buffer is 2880 as already stated, if this is recorded with the recording density of 360dpi, effective record length will be set to 203.2mm. In this, if Printer IJRA scans a recording head IJH with the speed for 460ms, record will be made by the width of face for 128 dots about the direction of vertical scanning by the one scan. Hereafter, the field recorded by one scan of a recording head IJH is called band. As each of this band is shown in

drawing 5 , for the processing mentioned later, about a main scanning direction, a division-into-equal-parts rate is carried out to 16 segments, and a segment number is given to each segment. Therefore, 180 dots is included in a main scanning direction, and data of 128 dots are included in one segment in the direction of vertical scanning. Moreover, the time amount taken to record the field of one segment is 31.5ms.

[0028] With this operation gestalt, while recording the contents of the line buffer 1 on a drawing area 1, the data corresponding to a drawing area 2 which are shown in drawing 5 and to record are stored in a line buffer 2, for example. Similarly, the data which record the contents of the line buffer 2 during record at a degree at a line buffer 1 are stored.

[0029] By the way, in the printer shown in drawing 1 , the recording head IJH with 128 nozzles of a configuration as shown in drawing 3 R> 3 is used, and this head is driven by supply voltage 24 V, 200mA of pulse current, the frequency of 6.25kHz, and driving pulse width of face sec of 5micro. If record which the ink regurgitation generates to all the pixels contained in one scan at this time is performed and the power consumption in a recording head will assume the effectiveness eta, such as a DC-DC converter or switching power supply, to be 80%, the power consumed when it actually sees from the input of a power source will become about 29W.

[0030] Drawing 6 is drawing showing the configuration of the circuit board which uses the silicon substrate of a recording head IJH as the base, and drawing 7 is the enlarged drawing of the circuit board of a field to which "B" and a sign were given in drawing 6 . As for the putt for [43 / the temperature sensor with which 41 used the silicon substrate and 42 used the meandering pattern of aluminum, and] wirebonding in 128 heating element groups and 44, the heater at which each heating element was equipped with 45, and 46, in drawing 6 - drawing 7 , an ink supply way and 48 are incubation heaters. With this operation gestalt, temperature control of a recording head IJH is performed for record upgrade so that clearly from such a configuration.

[0031] A temperature sensor 42 detects the temperature of the circuit board using the temperature coefficient of resistance of aluminum. If temperature specifically rises, the resistance of aluminum will increase at a fixed rate. Using this property, the temperature of the circuit board is detected and it controls to the appearance by which this is maintained by fixed temperature (for example, 40 degrees C) during record actuation activation. Generally, when the temperature of the circuit board becomes high, this is because it is necessary to amend the inclination which the discharge quantity of ink increases, and has the purpose which always maintains the discharge quantity of ink uniformly by controlling the temperature of the circuit board uniformly. Thereby, the high-definition record without concentration fluctuation is maintained also by the temperature change.

[0032] now -- a printer which is used with this operation gestalt -- in addition, if the power source (you may communalize with the power source for a recording head drive) for power-source [for logic actuation] (usually 5 V), conveyance motor 1709, and carrier motor 1710 drive etc. is required and these are included, the comprehensive power for which a power source is asked will be set to 35-40W. Since the size of an AC adapter is enlarged or the weight becomes heavy, it is not practical to offer such power with a cheap AC adapter etc. Therefore, in order to realize such a power source, the adapter of a switching method will usually be used, but although the miniaturization was attained when such an adapter was used, it was a trouble from the former to become expensive in cost.

[0033] In order to solve such a problem, with this operation gestalt, record data are treated in a segment unit as shown in drawing 5 . That is, the rate of an effective pixel or the number of effective dots is computed or counted in each segment unit of each band. The rate of an effective pixel here or the number of effective dots is the rate which shows what% of pixel is a pixel which needs the ink regurgitation, or its number of pixels among all the pixels (this operation gestalt 23040 dots (= 180x128 dots)) that each segment contains. It follows, for example, it is shown that that the rate of an effective pixel is 100% is a pixel for which all the pixels of the corresponding segment need the ink regurgitation.

[0034] Drawing 8 is drawing showing the example of the rate of an effective pixel of each segment contained in the drawing areas 1-4 on a record form (each area is equivalent to one band).

[0035] In drawing 8 the rate of an effective pixel the segment 8 of a drawing area 1, and the segment 2 of a drawing area 2 100% Both the segments 6 of (that is, the inside of the segment is deep-black), and drawing areas 1 and 2 50% of the rate of an effective pixel (-- namely, as for the segments 8 and 10 of a drawing area 2, in the segments 10-11 of halftone) and a drawing area 1, and the segments 11-12 of a drawing area 2, the rate of an effective pixel is [the rate of an effective pixel] less than 35% 35% or more (less than 50%) in the segment.

[0036] Moreover, as for the segments 4-5 of drawing areas 1 and 2, a deep-black field exists over two segments, respectively. However, when these fields are considered in each segment unit, the rate of an effective pixel is 35% or more (less than 50%) extent, as drawing 8 shows. Moreover, a deep-black field exists in the segment 13 of drawing areas 1 and 2 partially, respectively. The rate of an effective pixel is less than 35%, as drawing 8 shows. Here, it is asking for the rate of an effective pixel of the segment in case a deep-black field exists partially in a segment by the ratio of the segment width (a) about a main scanning direction, and the width of face (b) of the deep-black field about a

main scanning direction.

[0037] Next, the record control processing performed using a printer with the above configurations is explained with reference to the flow chart shown in drawing 9 . In addition, with the above configuration, although this printer is performing double buffer control, since it is well-known, in order to simplify explanation, it cannot touch that control about that control here.

[0038] First, at step S10, data are inputted into a line buffer through an interface 1700 from a host computer (un-illustrating). Next, at step S20, the rate of an effective pixel (number) ($X_i : 1 \leq i \leq 16$) is computed for every segment of the line buffer. Furthermore, as step S30 shows to drawing 10 , it asks for the average ($AVEX_i : 1 \leq i \leq 15$) of the rate of an effective pixel (number) of the adjoining segment (it is in a context about a main scanning direction), and the maximum ($MAXduty$) of these rates of an average effective pixel (number) is calculated at step S40.

[0039] Next, step S50 compares the maximum ($MAXduty$) with a predetermined threshold (here 30%). Here, if it is $MAXduty \geq 30\%$, as it progresses to step S60 and is shown in drawing 11 , processing will set up a recording mode and will perform record actuation so that record actuation of the Rhine may be considered as two pass control. On the other hand, if it is $MAXduty < 30\%$, as too shown in drawing 11 , a recording mode will be set up so that record actuation of the Rhine may be considered as one-pass control, and processing will progress to step S70. And at step S70, it asks for the rate ($AVEduty$) of an average effective pixel of the whole 1 band from the rate of an average effective pixel (number).

[0040] One-pass control here and two pass control are record control which controls the ink regurgitation from a nozzle to make the record actuation based on the data stored in each line buffer complete by 1 time and two carriage scans respectively.

[0041] For example, in two pass control, first, by the 1st carriage scan, as shown in drawing 12 , the data stored in line buffers 1 and 2 record the contents corresponding to the pixel black shown among each pixel, and record the contents corresponding to the pixel shown in white by the 2nd carriage scan. Although the relation between the pixel used for the 1st record and the pixel used for the 2nd record has become like a hound's-tooth check in the example shown in drawing 1212 , it cannot be overemphasized that the other combination is also possible.

[0042] By the way, a line buffer is divided into two or more segments as mentioned above, and there are the following advantages in determining a recording mode from the average of the rate of an effective pixel of the segment before and behind that (number).

[0043] For example, since it is necessary to energize at the heater of all the nozzles of a recording head if the deep-black field of the drawing area 2 of drawing 6 etc. is recorded when using an AC adapter or dropper type power source with a built-in body as a power source of a printer A power outlet falls below to allowed value level. The stepping motor for the object for record form conveyance or a carriage scan etc. stops operating normally, and The driver voltage of a recording head falls, and when the worst, the whole equipment may stop it becoming impossible to perform record actuation normally, and operating. Therefore, when a segment with high (that is, the rate of an effective pixel is high) record concentration exists, the fall of a power outlet is prevented by dividing into two carriage scans the record actuation based on the data stored in the line buffer.

[0044] If how much carries out period continuation and deep-black record as shown in the drawing area 2 of drawing 8 continues, whether the above functional disorders by the fall of a power outlet occur will take into consideration the threshold in the step S50 required for such control, and it will be determined. For example, if the case where these 100 dots include two segments is taken into consideration as shown in drawing 13 when a functional disorder arises that 100 dots of deep-black records follow a main scanning direction, and they follow it, the threshold about each segment must be set as 50 dots (it will be 27.8% if it says at the rate of an effective pixel). However, although according to such a view the deep-black field which continues 50 dots independently of one segment exists as shown in drawing 14 , even when there is no field accompanied by the ink regurgitation in the segment before and behind that, record control turns into two pass control about the band (namely, when it is a null region), and the recording rate to the band is reduced by half.

[0045] Therefore, with this operation gestalt, as mentioned above, it asked for the average of the number of effective pixels of a segment before and after adjoining a main scanning direction (rate), and the approach of the record control about that band is determined paying attention to the maximum of the number of average effective pixels about one line. Although record actuation will be performed by two pass control since the number of average effective pixels of two segments makes it the width of face and becomes 50 dots when a deep-black field as shown in drawing 13 $R > 3$ by carrying out like this exists Since the number of average effective pixels of two segments does not reach a threshold (here, equivalent to 50-dot width of face) when shown in drawing 14 , record actuation will be performed by one-pass control, and performance degradation is not caused.

[0046] If explanation is returned and continued to the flow chart of drawing 9 , step S80 compares the rate ($AVEduty$) of an average effective pixel of the whole 1 band with another predetermined threshold (here 20%). Here, if it is

AVEduty \geq 20%, as processing progresses to step S90 and is shown in drawing 11, record actuation (one-pass uni-directional record) will be performed only on the outward trip of 1 carriage scan. On the other hand, if it is AVEduty $<$ 20%, as processing progresses to step S90 and is shown in drawing 11 R> 1, record actuation (one-pass bidirectional record) will be performed in both the outward trip of 1 carriage scan, and a return trip.

[0047] "Uni-directional record" here and "bidirectional record" mean that a carriage scan carries out record actuation for restricting to the outward trip of a carriage scan and carrying out record actuation respectively in both an outward trip and a return trip. Therefore, the way of engine performance (throughput) as a printer which performs many bidirectional records and to carry out improves. However, by bidirectional record, since the average power consumption of a power source becomes large and the temperature rise for a power supply section becomes large in order to record in both the outward trip of a carriage scan, and a return trip, as shown in drawing 11, when record duty is small (the rate of an average effective pixel of the whole 1 band is small), it has applied with this operation gestalt. [0048] And after steps S60 and S90 or processing of S100 is completed, processing progresses to step S110, and it investigates whether the record actuation for 1 page was ended. Here, if judged as record continuation, processing will return to step S10, above-mentioned processing will be repeated, but processing will be ended if judged as record actuation termination.

[0049] Therefore, according to the operation gestalt explained above, a line buffer is divided into a still smaller segment. It asks for the rate of data that the segment unit is made to start the ink regurgitation (as [need / namely, / power consumption]). Since a recording mode is changed for every band and record control is performed based on the rate, and it divides into the carriage scan of multiple times about a record band with which power consumption becomes large especially and is made to perform the record, it becomes possible to reduce the peak value of power consumption. It becomes possible to mount the power source of a small capacity in equipment, and a miniaturization and low-cost-izing of a power source are further promoted by this. Furthermore, in one-pass control, since selection of bidirectional record or uni-directional record is performed, although the temperature rise of a power source is also considered from the rate of an average effective pixel of the whole 1 band, there is an advantage that a recording rate can be raised depending on record conditions.

[0050] In addition, this invention is not limited by this although this operation gestalt explained as an example the recording head which has 128 nozzles in the direction of vertical scanning, and the configuration which has two line buffers. For example, 256, 512, 1024, etc. is sufficient as the number of nozzles of a recording head, and the number of line buffers can also be increased in consideration of the engine performance of a printer and the whole system including a host if needed. Furthermore, although the size of the direction of vertical scanning of a line buffer was 128 dots, it cannot be overemphasized that this value is changeable according to the number of nozzles of a recording head (recording width).

[0051] Moreover, with this operation gestalt, although one predetermined threshold performed the change to one-pass record and two pass record, this invention is not limited by this. For example, it is also possible by establishing two or more thresholds to prepare the recording mode which can perform record by further many pass records.

[0052] Furthermore, this invention is not limited by this, although the recording mode was determined with this operation gestalt by making into a parameter record duty searched for per segment of each line buffer, and average duty of each line buffer as shown in drawing 11. For example, the power consumption of the incubation heater of a recording head etc. may be applied as a parameter which determines a recording mode.

[0053] Especially the above operation gestalt is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet recording method in order to make the ink regurgitation perform, and can attain the densification of record, and highly minute-ization by using the method which makes the change of state of ink occur with said heat energy.

[0054] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports recording information and exceeds film boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by 1 to 1 as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles, and contraction, and at least one drop is formed. If the shape of a pulse form is carried out, since growth contraction of air bubbles will be appropriately performed instantly in this driving signal, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0055] As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification

and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0056] The configuration using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the configuration arranged to the field to which a delivery which is indicated by each above-mentioned specification, a liquid route, and the heat operating surface other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of an electric thermal-conversion object are crooked as a configuration of a recording head is also included in this invention. In addition, it is good also as a configuration based on JP,59-138461,A which indicates the configuration whose opening which absorbs the pressure wave of JP,59-123670,A which indicates the configuration which uses a common slot as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part.

[0057] Furthermore, any of the configuration which fills the die length with the combination of two or more recording heads which are indicated by the specification mentioned above as a recording head of the full line type which has the die length corresponding to the width of face of the maximum record medium which can record a recording device, and the configuration as one recording head formed in one are sufficient.

[0058] In addition, the recording head of the exchangeable chip type with which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained may be used by not only the recording head of the cartridge type with which the ink tank was formed in the recording head itself explained with the above-mentioned operation gestalt in one but the body of equipment being equipped.

[0059] Moreover, since record actuation is further made to stability, it is desirable to add the recovery means against a recording head, a preliminary means, etc. to the configuration of the recording device explained above. If these are mentioned concretely, there is a preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head etc. Moreover, it is effective in order to perform record stabilized by having the reserve regurgitation mode in which the regurgitation different from record is performed.

[0060] Furthermore, by constituting not only the recording mode of only mainstream colors, such as black, but a recording head in one as a recording mode of a recording device, even with two or more combination, although it is good, it can also consider as equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0061] In the gestalt of the operation explained above, although it is explaining as a premise that ink is a liquid Even if it is ink solidified less than [a room temperature or it], what is softened or liquefied at a room temperature may be used. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself by within the limits below 70-degreeC more than 30-degreeC and it is in the stabilization regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0062] In addition, in order to prevent positively by making the temperature up by heat energy use it positively as energy of the change of state from a solid condition to the liquid condition of ink, or in order to prevent evaporation of ink, the ink which solidifies in the state of neglect and is liquefied with heating may be used. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied also when using the ink of the property which will not be liquefied without grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. In such a case, ink is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0063] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0064] Moreover, this invention may be applied to the system which consists of two or more devices, and may be applied to the equipment which consists of one device. Moreover, it cannot be overemphasized that this invention can be applied also when carrying out by supplying a program to a system or equipment. In this case, the storage which stored the program concerning this invention will constitute this invention. And the system or equipment operates by the method defined beforehand by reading the program from this storage to a system or equipment.

[0065]

[Effect of the Invention] As explained above, according to this invention, have two or more record elements and the

both-way scan of the recordable recording head is carried out by energizing to said two or more record elements. In case it records on a record medium, input record data from the exterior and it stores in a storage by making into one unit the record data corresponding to the record length recorded by one scan of a recording head. The record data for the one unit are divided into two or more partitions. For every divided partition of the A result is followed. the number of pixels corresponding to the data made to generate record actuation -- counting -- carrying out -- the counting -- Since it controls to determine by how many times scan of a recording head the record data of one unit are recorded, and to record by scanning a recording head based on the decision result It is effective in the ability to stop the power needed since a recording head is driven in one record actuation.

[0066] By this, it becomes possible to suppress small the power source which supplies the power needed for equipment, for example, contributes to the miniaturization of equipment, or reduction of an equipment production cost.

[0067] Moreover, since record data are not necessarily thinned out, it divides into the scan of two or more recording heads and record is only performed by the above-mentioned control, there is an advantage that the quality of a record image does not deteriorate.

[0068] Furthermore, since it controls according to the number of average pixels per recording head each scan to perform record actuation by the both-way scans in each according to invention according to claim 5 to 6, depending on the number of pixels of record data, a recording rate can also be raised further.

[0069]

[Translation done.]